



## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# Multifragmentary dislocated humeral head fracture—A case report of a successful head preserving treatment strategy despite delayed presentation

Matthias Bungartz\*, Georg Matziolis, Sebastian Rohe, Olaf Brinkmann

Orthopaedic Department, Campus Eisenberg, Friedrich-Schiller University, Jena, Germany

## ARTICLE INFO

### Article history:

Received 17 August 2016  
Received in revised form 27 October 2016  
Accepted 27 October 2016  
Available online 29 October 2016

### Keywords:

Case report  
Humeral head fracture  
Intramedullary nailing  
Intramedullary osteosynthesis  
Prosthetic fracture treatment

## ABSTRACT

**INTRODUCTION:** Head preserving, delayed osteosynthesis five days after a luxated, multifragmentary humeral head fracture is rarely seen and a challenge for the surgeon.

**PRESENTATION OF CASE:** This case history describes the case of a 69-year-old female with delayed head preserving treatment of a dislocated multifragmentary humeral head fracture using intramedullary nailing, avoiding a primary trauma arthroplasty after strict refusal of the patient despite poor prognosis and high risk of avascular humeral head necrosis.

**DISCUSSION:** The treatment of the humeral head fracture is still a matter of debate, the “golden standard” does not exist, especially in the deferred luxated situation. With the use of modern implants head preserving treatment is reasonable and possible. It should therefore always be taken into account as an alternative for arthroplasty.

**CONCLUSION:** Excellent postoperative outcome can be achieved by joint reconstruction eliminating the possible side effects of shoulder endoprosthesis.

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## 1. Introduction

This case report describes the delayed head preserving treatment of a dislocated multiple fragment humeral head fracture (Codman-Hertel type 12, AO 11C3.3) using intramedullary nailing in a regional trauma care unit. We want to show that, despite severe radiographic findings and contrary to the general recommendation [1], a very good postoperative outcome can be achieved by joint reconstruction and abandon to an implantation of a fracture prosthesis. For publishing this case report we considered the SCARE-criteria for good clinical case reports [2].

## 2. Medical history

The 69-years old female patient fell onto her left shoulder on 23 August 2013. She then presented at a local emergency department. A luxated proximal humerus dislocation fracture (AO 11C3.3, Codman-Hertel type 12) was diagnosed and a repositioning attempt was made along with immobilisation in a Gilchrist's bandage (Fig. 1). After emergency treatment, the further treatment was given at our hospital, a regional trauma care unit, from 26 August 2013 onwards. A CT was performed to complete diagnosis

tics for planning surgical treatment. It showed a multiple fragment dislocation fracture of the humeral head (Fig. 2).

The patient, a retired designer, revealed past medical history of reflux oesophagitis, hypothyroidism and received radiotherapy for breast cancer in 2010. On admission she showed no signs of neurovascular deficits.

After the patient had been informed about the possible treatment strategies (endoprosthesis, osteosynthesis using a medullary nail or fixed-angle plate, conservative approach), she expressly requested that joint-sparing surgery should be attempted, despite the considerable risk of humeral head necrosis.

Treatment with an endoprosthesis was explicitly rejected by the patient, although this is currently recommended for this fracture type [1,3].

## 3. Surgical technique

Five days after fracture event, osteosynthesis was performed under intubation anaesthesia in the beach-chair position by an experienced senior surgeon. The fracture fragments were exposed via an anterolateral approach, whereby the axillary nerve was identified and protected. Initially, the dislocated head was anatomically repositioned and then opened in line of the humeral medullary canal using a hollow reamer. The osteochondral cylinder which is regularly obtained after preparation for creating the entrance point of the nail was then extracorporally processed by removing carti-

\* Corresponding author.

E-mail address: [mat.bungartz@gmail.com](mailto:mat.bungartz@gmail.com) (M. Bungartz).

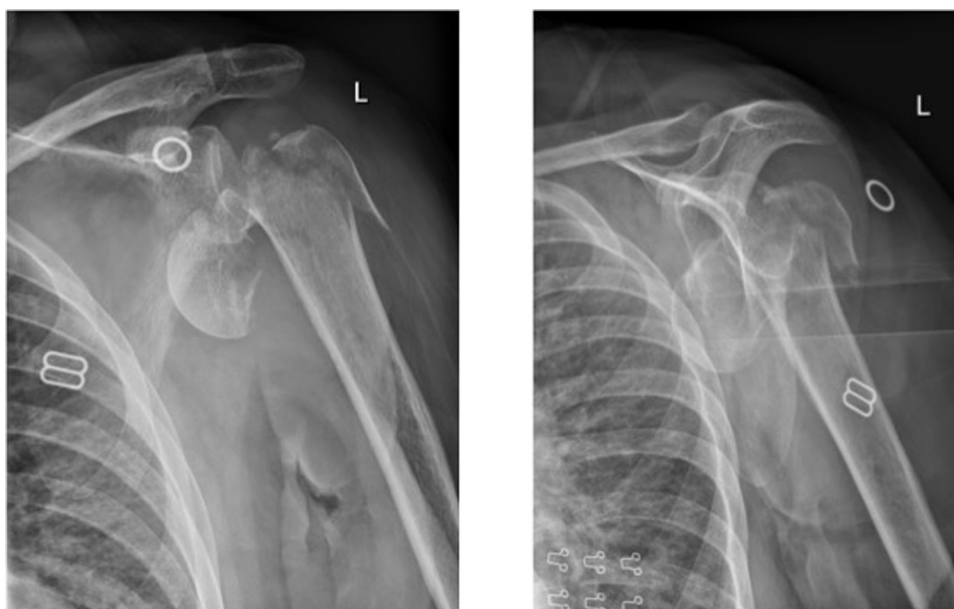


Fig. 1. Radiographs of the humerus fracture.

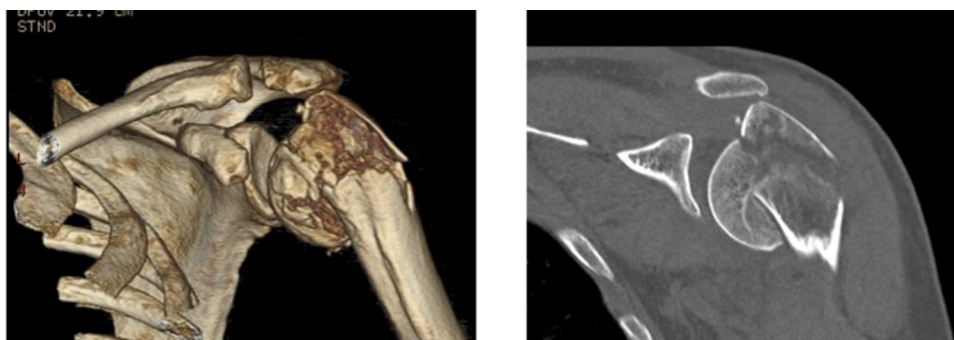


Fig. 2. Computed tomography of the humerus fracture.

lage and reducing it into small pieces and later reinserted in the subcortical fracture zone as a supporting conductive autologous bone graft.

Then, the proximal humerus nail was inserted (Targon PH®, Aesculap, Tuttlingen, Germany) and the tubercles were finely repositioned and directly osteosynthetically secured using screws through the corresponding holes of the nail. Finally, the nail was double locked distally, additionally the fixation of the greater tubercle and the rotator cuff was supported by transosseous non-resorbable sutures (FiberWire®).

#### 4. Postoperative treatment

The limb was initially immobilized in a Gilchrist's bandage. Then, on the second postoperative day, early functional physiotherapeutic training of the shoulder and elbow was started. The patient was trained for 3 weeks with passive joint mobilisation and without limitation of the range of motion under physiotherapeutic guidance. Furthermore we used a CPM splint to improve the range of motion. This was followed by actively assisted motion. Bone healing was supported by exogenous ultrasound (Exogen®, Bioventus, Durham, N.C. USA).

One year after surgery, the patient was subjectively satisfied with function, had no limitations in her activities of daily life and needed no analgesics. Radiologically, a consolidated fracture was seen without any signs of humeral head necrosis (Fig. 3). Shoulder

mobility was slightly reduced compared to the non-affected side (Fig. 4). The Constant score was 92 points on the left and 96 points on the right.

#### 5. Discussion

The proximal humeral head fracture accounts for 6% of all fractures and affects women three times more likely than men. The fracture occurs frequently in postmenopausal women and its incidence is rising with the increased ageing of the population [4].

As a result of the increasing incidence of this fracture and the multi-morbidity of those patients, the question of the optimum treatment still remains a matter of debate. This case report describes a joint-sparing alternative to the currently favoured endoprosthetic treatment of multiple fragmented, dislocated fractures [1]. At the same time, the possibility of secondary endoprosthetic treatment remains a rescue strategy in the event of postoperative humeral head necrosis [5]. With regard to the outcome, the current literature points to an inconsistency in the comparison of secondarily and primarily implanted endoprosthesis in the case of humeral head fractures. Some authors report a deterioration of function in case of secondary joint replacement [5], whereas others were unable to find any significant differences [6]. So there is no contra indication for a secondary joint replacement after the attempt of a joint-sparing treatment.

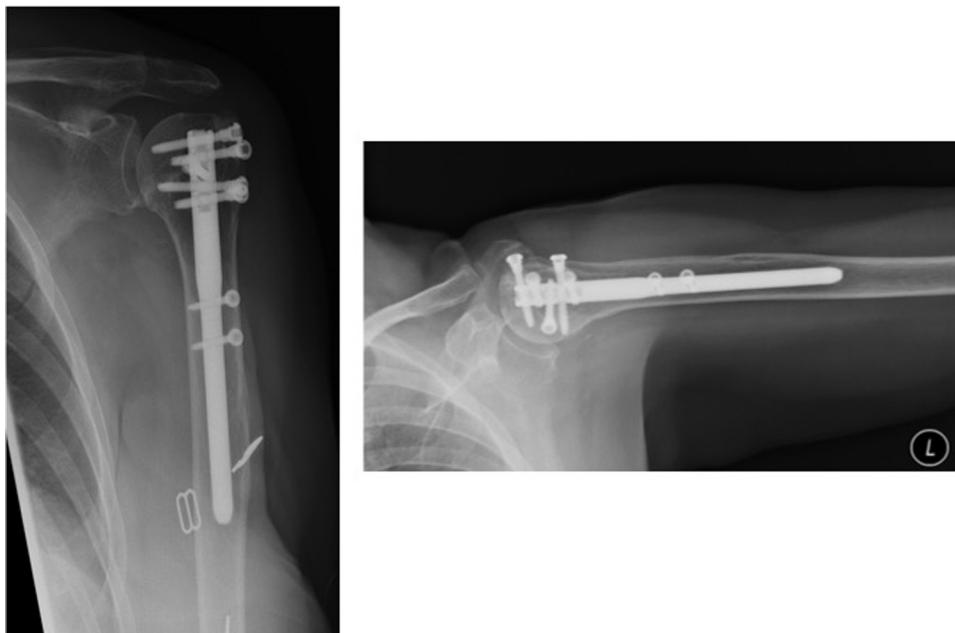


Fig. 3. Postoperative radiograph of the nailed humerus.

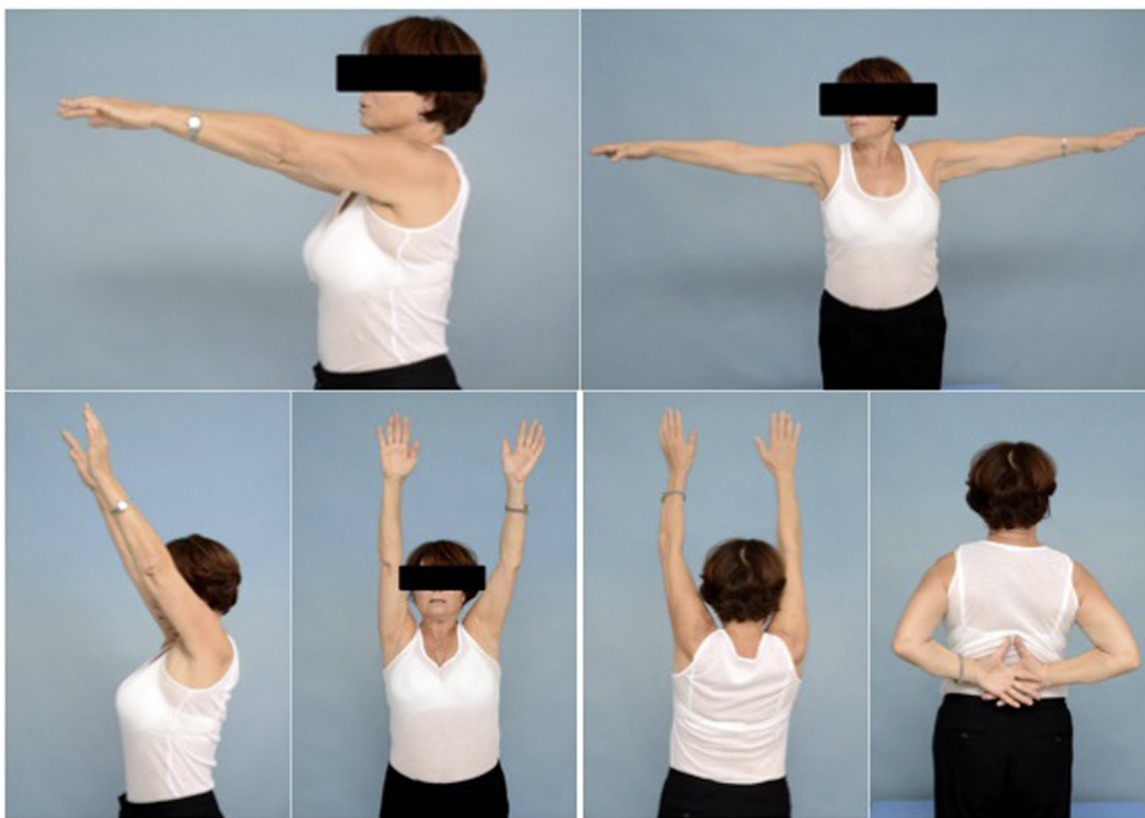


Fig. 4. Functional result one year after surgery.

From a medical point of view, several influencing factors must be taken into account in the choice of therapeutic procedure for the above-mentioned fracture.

First, the status of the rotator cuff is a limiting factor for the functional outcome in a joint-sparing procedure [7]. Thus, an intact cuff is desirable for osteosynthesis or implantation of a fracture endoprosthesis. The prevalence of rotator cuff defects in patients with humeral head fractures reported in the literature is the subject

of considerable debate and ranges from 5% to 50% [8], which makes it difficult to make any general assertion about the status of the rotator cuff preoperatively.

A further influencing factor is the critical, individually strongly varying circulatory situation of the humeral head. A MRI study of 12 shoulder cadavers revealed that the humeral head is perfused by the posterior humeral circumflex artery in 2/3 of the cases and by the anterior humeral circumflex artery in 1/3 of the cases [9],

which means that the posterior humeral circumflex artery takes on a more important role than previously assumed. Nevertheless, the circulatory situation varies considerably on an individual basis due to numerous anastomoses and individual anatomical peculiarities [10]. Hertel defined 3 fracture characteristics predicting the probability of an avascular humeral head necrosis [11]. In this particular case the combination of a small calcar beak (<8 mm), a destroyed medial hinge and a displaced fracture of the anatomical neck predicts an extremely heightened (97%) risk rate for an avascular necrosis of the humeral head [11]. His criteria are important for surgical planning, especially in combination with a CT. On the other hand actual studies show Hertel's criteria considered alone cannot sufficiently predict a humeral head necrosis [12]. At the end the individual variability of vascular perfusion still considerably limits the ability to make a preoperative prognosis concerning the risk of head necrosis after a fracture and subsequent to osteosynthesis [13].

Beside head perfusion, bone metabolism also plays an important role for osseous consolidation. In the case of manifest osteoporosis, the fracture pattern is usually more complex and the risk of failure of the osteosynthesis is higher as a result of the limited fixation options [14]. In all cases, the exact anatomical reconstruction of the calcar appears to be decisive as a biomechanically relevant supporting structure [11].

However, it remains unclear which treatment strategy (type of osteosynthesis, endoprosthetic treatment) should be pursued for which fracture morphology [1].

Small population studies show that intramedullary nailing can also achieve good postoperative results in 3- and 4-fragment fractures in the case of very good reconstruction of the fragments [15,16].

The reported evidence of good outcome after joint-sparing surgery in literature and our experience with intramedullary nailing in multiply fragmented humeral head fractures, encourages us attempting a biological osteosynthesis when technical feasible, despite the high risk of a secondary head necrosis, whereby the secondary prosthetic treatment can be a non-compromising solution in this case. That's why we set the indication for the above described treatment in this special case.

## 6. Conclusion

The intense debate concerning the best option for treating a multiple fragment dislocated humeral head fracture reflects the fact that the decision must always be made on an individual basis. In practice, the therapy decision for or against a joint-sparing attempt often depends not only on objectifiable parameters such as fracture morphology or patient-specific factors, but also on the surgeon's preference.

This individual case is insufficient to challenge the validity of the currently often favoured procedure of primary joint replacement in the case of multiple fragment dislocation fractures of the humeral head. However, it documents the fact that a joint-sparing attempt is possible with a good functional outcome in individual cases and that the choice of procedure should be given critical consideration if the anatomical and logistical preconditions allow joint sparing.

## Conflicts of interest

None.

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## Funding

None.

## Ethical approval

Not required.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request".

## Author contribution

MB, GM, SR, OB—concept and design, writing, data analysis interpretation SR—data collection.

## Guarantor

Matthias Bungartz (corresponding author).

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